

Maine Space Grant Consortium  
Lead Institution: Maine Space Grant Consortium  
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## **PROGRAM DESCRIPTION**

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Maine Space Grant Consortium is a Capability Enhancement Consortium funded at a level of \$660,000 for fiscal year 2010.

## **PROGRAM GOALS**

The mission of the Maine Space Grant Consortium (MSGC) is to (a) Improve our Affiliates research infrastructure in areas of mutual interest to NASA and the state of Maine; (b) Encourage more students to consider careers in fields of science, technology, engineering, and mathematics (STEM); and (c) Enhance NASA's presence throughout the State of Maine.

### **A. Goals and Objectives Relevant to NASA Education Outcome 1:**

The MSGC's Research Infrastructure, Higher Education and Workforce Development goals are in alignment with activities to achieve Outcome 1. These goals are to: (a) strengthen the Affiliates' STEM research capacity in areas mutually beneficial to NASA and Maine (Research Infrastructure); and (b) to increase participation of Maine undergraduate and graduate students in STEM research conducted by the Affiliates and NASA Field Centers (Higher Education and Workforce Development).

To achieve these goals in a manner that will yield results consistent with Outcome 1, we supported the following objectives:

- a. Support scholarships and fellowships for undergraduate and graduate students at Maine's graduate institutions to conduct STEM related research.
- b. Support scholarships for Maine undergraduate students matriculating at Maine's primary undergraduate institutions to conduct STEM related research.
- c. Increase STEM student enrollment at the University of Maine, University of Southern Maine and the College of the Atlantic by augmenting institutional scholarships to attract highly qualified high school seniors.

- d. Provide undergraduate students with a 10-week research experience at NASA field centers.
- e. Support new STEM course offerings.

#### **A. Goals and Objectives Relevant to NASA Education Outcome 2**

The MSGC's Higher Education and Pre-College goals are in alignment with activities to achieve Outcome 2. These goals are to: (a) to increase participation of Maine undergraduate and graduate students in science and engineering research conducted by the Affiliates and NASA Field Centers (Higher Education); and (b) increase participation of Maine K-12 teachers and high school students in STEM activities through professional development activities for in-service and pre-service educators, curriculum development, teacher workshops and student-based programs (Pre-College). To achieve these goals in a manner that will yield results consistent with Outcome 2, we proposed to support the following objectives:

- Support STEM research experiences for High School Juniors and K-12 teachers
- Support a pre-college curriculum/professional development program
- Support existing programs designed to help teachers and school districts acquire and utilize NASA and NASA related educational programs and resources.
- Develop partnerships to leverage and expand K-12 initiatives that connect schools to science and engineering research and educational strengths of the Affiliates

#### **B. Goals and Objectives Relevant to NASA Education Outcome 3**

The MSGC's Informal Education goal is in alignment with activities to achieve Outcome 3. The goal is to increase the public's awareness of STEM research, education and activities that are associated with NASA and the Affiliates. To achieve this goal in a manner that will yield results consistent with Outcome 3, we proposed to implement the following objective:

- Support one innovative educational project that uses NASA themes and contents.

### **PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)**

Outcome 1. Alison Chase, a scholarship recipient from Bowdoin College conducted research work that analyzed phytoplankton counts and absorption to determine the types and concentrations of phytoplankton in the water. This analysis was applied to the use of remote sensing for monitoring harmful Algal Blooms. Alison credits her MSGC funded research as the key to her being hired by her employer, the Atmospheric and Environmental Research, Inc. As a research Associate, she is working on a project that is directly related to her MSGC funded research.

*"My MSGC grant and the project that came from it, led me directly to a great job as a young professional." (Alison Chase)*

Outcomes 1 and 2: William Ferm, Jr. was a Sophomore Engineering Physics major when he applied to our Maine Aerospace Workforce Development program. To his surprise and delight he was accepted in a project at the Glenn Research Center. He was extremely nervous and

wondered if he was prepared enough as a student to conduct work at NASA. Upon arriving at the center he spent the first days reading literature, learning new terms and vocabulary, and asking a lot of questions. He was intimidated when observing experiments and found it difficult to fully understand conversations between his mentors and colleagues. After a month of reading, asking questions and following directions he realized that something had changed, that he understood the concepts of the work and conversations, but realized there was a slight language barrier – an engineering “lingo” he didn’t fully understand. Armed with that knowledge, he took a concerted effort to learn the “lingo”. He went from strictly observing experiments to confidently setting up, conducting and analyzing data all on his own.

*“To describe the amount that I have learned during these ten weeks at the NASA Glenn Research Center could probably become the length equivalent of a senior thesis.” (William Ferm, Jr.)*

Outcome 2. Anne Lausier participated in our MERITS program during her junior year in high school in 2008. She was accepted to the George Washington University where she is currently a sophomore majoring in Environmental Studies and Geography with a minor in Geology. Through the MERITS program, she participated in a research project titled “Exploring the Quality of Drinking Water Sources through Spectrofluorimetry”, at the University of Maine’s Chemistry Department. Since Anne’s internship through the MERITS program and working in the Chemistry Department, she has published a paper in the Journal of the U.S. Stockholm Junior Water Prize, presented her research twice – one poster at the US Stockholm Junior Water Prize Competition (Sponsored through the Water Environment Federation) at the University of Alaska in Anchorage and one oral presentation at the Northern New England Junior Science and Humanities Symposium at the University of New Hampshire. She was also the Maine State winner for U.S. Stockholm Junior Water Prize, and placed in the top ten at the national level. She also received fourth place at the Northern New England Junior Science and Humanities Symposium. Anne was able to continue her research in the lab after the MERITS program ended. She credits her involvement and experience gained through the MERITS program for her accomplishments in these areas.

Outcome 2. William Curley participated in our MERITS program in the summer of 2009. Will is now attending Embry-Riddle Aeronautical University in Florida majoring in Aerospace Engineering with a concentration in Propulsion. Through the MERITS program, Will interned at a MSGC affiliate company, Applied Thermal Sciences, Inc. (ATS) working directly with propulsion technology. Will credits his experience working at ATS in his decision to continue his education into Aerospace Engineering.

*“After participating in the MERITS program, I became more interested in space and the aeronautics industry as a whole. I joined FIRST robotics and it allowed me to get some hands on experience with what a day in the life of an engineer would be like. Now that I’m in college I have joined the AIAA (American Institute of Aeronautics and Astronautics) which allows me to hear about the field of Aerospace Engineering. I really appreciate the opportunity that MERITS gave me. It solidified my interest in engineering and showed me what my life would be like as an engineer”. Thank you all again!” (William Curley)*

We recently followed up with Will to see how things were progressing for him. He had some great news for us in his academic progression.

*“I have to say MERITS hands on experience with my degree (Aerospace Engineering/Propulsion) has definitely helped me with making my career choice solid. The experience I gained from MERITS allowed me to excel in my first year of college and put me ahead of the rest of the students. For example in my MERITS project I used the program Solidworks often, and in an Aerospace Engineering job I'll be using Solidworks or a similar program CATIA daily. I actually have a CATIA final tomorrow so MERITS is helping me out even today!” (William Curley)*

Outcomes 1 and 2. The College of the Atlantic (COA) developed a new interdisciplinary higher education course (reported in 2009) on the mathematics and physics of sustainable energy. This course was implemented as planned and will continue to be offered at the COA. Since this time, a professor at another higher education institution Husson College, (not affiliated with MSGC) has been in close contact with the PI on this project, Dr. Feldman at COA to modify the course outline to use at their institution. Husson College plans to offer the course in the fall of 2011. *“We are pleased that this project has helped form this collaboration and that a new sustainable energy course at another college in Maine will result” (Dr. David Feldman, College of the Atlantic)*

## PROGRAM ACCOMPLISHMENTS

Outcome 1: *“Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals”*

**MSGC Goal for Scholarships and Fellowships:** Increase the participation of Maine undergraduate and graduate students in STEM research conducted by the Affiliates and NASA Field Centers.

Objectives:

1. On an annual basis, at least 62 undergraduate and graduate students (51 tracked and 11 non-tracked) will receive scholarships and fellowships to participate in NASA-related STEM research conducted by the Affiliates and NASA field centers.
  - a. Accomplishments: 40 undergraduates and graduate students (30 tracked and 10 non-tracked) have received scholarships and fellowships. ***NOTE: As of this report date, all data has not been collected due to the timing of the awards and the student projects. The number of student awards will increase.***

**MSGC Goal for Research Infrastructure:** Strengthen the Affiliates science and engineering research capacity in areas mutually beneficial to Maine and NASA.

Objectives:

1. On an annual basis, at least four research collaborations between affiliates and NASA Centers will be seeded.

- a. Accomplishments: Two research collaborations between affiliates and NASA centers
2. On an annual basis, at least eight faculty will be supported in research collaborations between affiliates and NASA centers.
  - a. Accomplishments: Two faculty and one industry researcher supported in research collaborations between affiliates and NASA centers
3. On an annual basis, at least eight undergraduates and graduate students (four tracked and four not-tracked) will participate in NASA-related STEM research conducted by affiliates
  - a. Accomplishments: Nine undergraduate and graduate students (five tracked and four not-tracked) participated in NASA-related STEM research conducted by affiliates
4. On an annual basis, at least one new research collaboration between an Affiliate and Minority Serving Institution will be seeded
  - a. Accomplishments: One collaboration was conducted
5. On an annual basis, at least two faculty will be supported in the research collaborative between an affiliate and a Minority Serving Institution.
  - a. Accomplishments: One faculty was supported
6. On an annual basis, at least two undergraduate and graduate students will participate in a collaboration with a Minority Serving Institution
  - a. Accomplishments: Five students participated (one student counted, four students not counted) in a collaboration with a Minority Serving Institution

**MSGC Goal for Higher Education:** Increase participation of Maine undergraduate and graduate students in science and engineering research conducted by the affiliates and NASA Centers

**Objectives:**

1. On an annual basis, at least eight undergraduate and graduate students (five tracked and three not-tracked) will participate in NASA-related STEM research conducted by the affiliates.
  - a. Accomplishments: Eight students participated (all not-tracked) in NASA-related STEM research conducted by affiliates
2. On an annual basis, at least three courses that integrate NASA-related resources into STEM disciplines will be developed or improved
  - a. Accomplishments: Two courses have been developed (1) or improved (1)
3. On an annual basis, at least eight undergraduate students (all tracked) will participate in summer research experiences in NASA-related STEM research conducted at Maine Technology-based companies and/or NASA Field Centers
  - a. Accomplishments: Ten student participants (nine tracked, one non-tracked) have been placed in research experiences at NASA Field Centers

Outcome 2: *“Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers and faculty”*

**MSGC Goal for Pre-College:** Increase participation of Maine K-12 teachers and high school students in STEM activities:

Objectives:

1. On an annual basis, at least seven middle and high school teachers will participate in summer research experiences in NASA-related STEM research
  - a. Accomplishments: One teacher participant
2. On an annual basis, at least 12 high school juniors will participate in summer research experiences in NASA-related STEM research
  - a. Accomplishments: 13 high school juniors will participate in summer research experiences. As of this report date, the program is not complete and all the data has not been received. This number is expected to increase to 19
3. On an annual basis, at least three new or improved curricula that uses NASA themes and content will be introduced in Maine K-12 schools
  - a. Accomplishments: One new curriculum has been developed and introduced
4. On an annual basis, at least seven middle school teachers will use NASA contents and themes to enhance their STEM curricula
  - a. Accomplishments: 1 teacher will use NASA content. As of this report date, the program is not complete and all the data has not been received. The number of teachers using NASA content is expected to increase
5. On an annual basis, at least 80 middle school students will be exposed to NASA-mission related activities, STEM disciplines and careers
  - a. Accomplishments: Over 1500 middle and high school students have been exposed to NASA related activities

Outcome 3: *“Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA’s mission”*

**MSGC Goal for Informal Education:** Increase the public’s awareness of STEM research, education and activities that are associated with NASA and the affiliates

Objectives:

1. On an annual basis, at least one informal education activity that uses NASA themes and content will be supported
  - a. Accomplishments: One informal education activity has been/will be supported. As of this report date, the program is not complete and the data has not been received.
2. On an annual basis at least 50 students will have a better appreciation of STEM and NASA
  - a. Accomplishments: As of this report date, the program is not complete and the data has not been received. It is expected that we will meet or exceed this objective

**NASA 2010 Education Priorities:** “Accomplishments related to the “Current areas of emphasis” stated in the 2010 solicitation.

1. Authentic, hands-on student experiences in science and engineering disciplines...:
  - a. MSGC’s Scholarship and Fellowship Program (page 4), Research Infrastructure (page 4-5), Higher Education (page 5) and MERITS program (pages 5-6 under pre-college programs) apply to this priority area
2. Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise..
  - a. MSGC’s MERITS program (pages 5-6 under pre-college programs) apply to this priority area
3. Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers
  - a. MSGC’s MERITS program (pages 5-6 under pre-college programs) apply to this priority area
4. Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research towards NASA priorities.
  - a. MSGC’s Research Infrastructure Program (page 4-5) apply to this priority area

## PROGRAM CONTRIBUTIONS TO PART MEASURES

• Longitudinal Tracking: Number of student participants who are:	
Employed by NASA	5
Employed by Aerospace Contractors	3
Employed by Universities	1
Employed by other education institutions	7
Employed in other STEM fields	35
Pursuing advanced education in NASA-related disciplines	44
Underrepresented	17

MSGC longitudinally tracks students that receive a significant award or benefit from the award/experience. Notices are sent out to these students twice annually requesting information on their academic and workforce status as well as data on publications, presentations, and proposals submitted to other funding agencies, as a result of their Space Grant award.

• Course Development:	
New courses	2
Revised course	1

One new course on MEMS technology was developed title “Micro-Electro-Mechanical-Systems, MEMS” EGN 446, by Prof. Guvench and was offered to students at the University of Southern Maine.

One course at the University of Maine (ECE 316) was revised to incorporate the above MEMS technology that was newly developed.

One new high school curriculum was developed and implemented into two honor physics classes at one high school. This curriculum was also modified and will be used at a second high school in their advanced placement physics group.

- Matching Funds: Total matching funds for 2010 is \$480,000, which consists of:

Academic Affiliates	\$330,698
Non-profit	20,485
Industry	98,377
Other non-federal	10,460
Lead institution	19,980
- Minority-Serving Institutions: There are no minority serving institutions in the State of Maine. MSGC implemented a collaborating program with California State Long Beach, Department of Mechanical and Aerospace Engineering (minority serving institution) and the University of Maine, Department of Electrical and Computer Engineering in 2008. The project finished in 2009. In 2010 we explored the possibility of partnering with another minority serving institution in Ohio, but unfortunately we did not find a good fit at the time. We then continued our collaboration with California State Long Beach in 2010. Going forward, we will explore opportunities with additional minority serving institutions.

## IMPROVEMENTS MADE IN THE PAST YEAR

Nothing to report for this funding period.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

### **Higher Education Affiliates**

- Bates College, 4-year or above, Private, Baccalaureate College-Liberal Arts
- Bowdoin College, 4-year or above, Private, Baccalaureate College-Liberal Arts
- Colby College, Waterville, 4-year or above, Private, Baccalaureate College-Liberal Arts
- College of the Atlantic, Bar Harbor, 4-year or above, private, Baccalaureate College-Liberal Arts
- Embry-Riddle Aeronautical University, 4-year
- University of Maine, Orono, 4-year or above, Public, Doctoral/Research-Extensive, member of the Board of Directors
- University of Southern Maine, Portland, 4-year or above, Public, Master's Colleges and Universities II, member of the Board of Directors
- University of New England, Biddeford, 4-year or above, Private, Master's Colleges and Universities II.
- Maine Maritime Academy, Castine, 4-year or above, Public, Specialized Institutions



**Non-Higher Education Affiliates**

- Bigelow Laboratory for Ocean Sciences, Boothbay Harbor, Marine Research and Education, member of the Board of Directors
- Gulf of Maine Research Institute, Portland, Private not-for-profit, Marine Research and Education
- Maine Manufacturing Extension Partnership, Augusta, Private not-for-profit, Manufacturing Extension, member of the Board of Directors
- Applied Thermal Sciences, Sanford, High Tech Small Business, member of the Board of Directors
- Maine Mathematics and Science Alliance, Augusta, Private not-for-profit, Education, member of the Board of Directors
- The Challenger Learning Center of Maine, Bangor, Private not-for-Profit, Education
- BioAnalyte, Portland, Industry
- Island Astronomy Institute, Private not-for-Profit, Education
- Lockheed Martin, Industry